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Integration and SOA background

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Objectives

- At the end of this session you should have a good understanding of:
  - Approaches to integrating systems
  - RPC and Message based approaches
  - Service Oriented Architecture
  - Benefits of loose coupling

What Is IT From A Business Perspective

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- IT is a Business Resource
- Business Resources Focus On Addressing Business Problems
- How Do We Leverage Business Resources (IT and Others) to Address Problems....Service Orientation.
- Service Orientation is **NOT** IT Centric! Its Business Centric.

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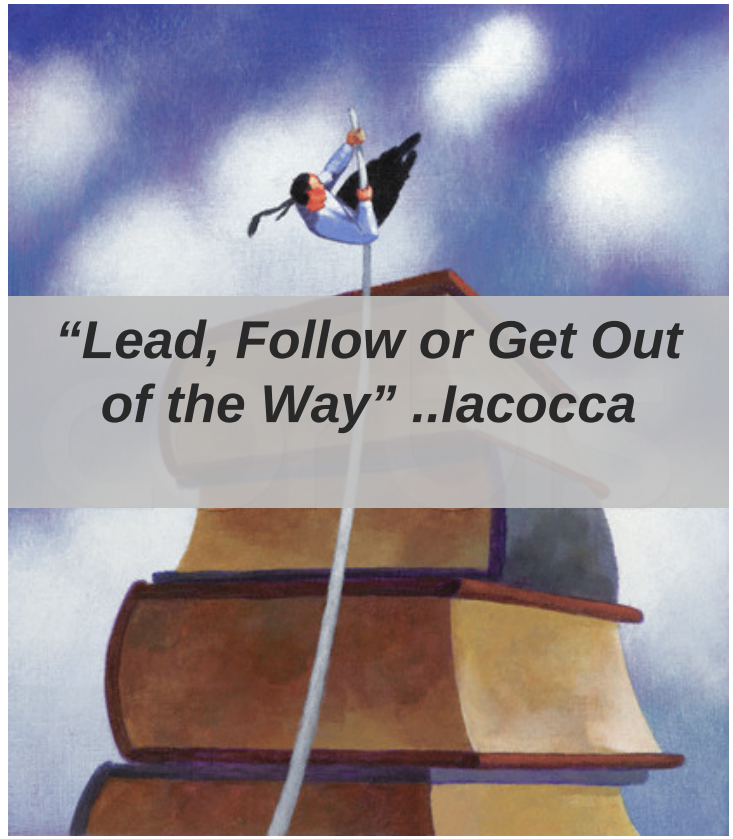
Organizational Agility

- Ability to Respond Quickly **AND** Efficiently and Leverage Change for Constituency Advantages
- Two Parts
  - Tactical: Ability to Respond – Faster is Better!
  - Strategic: Leverage Change for Advantage



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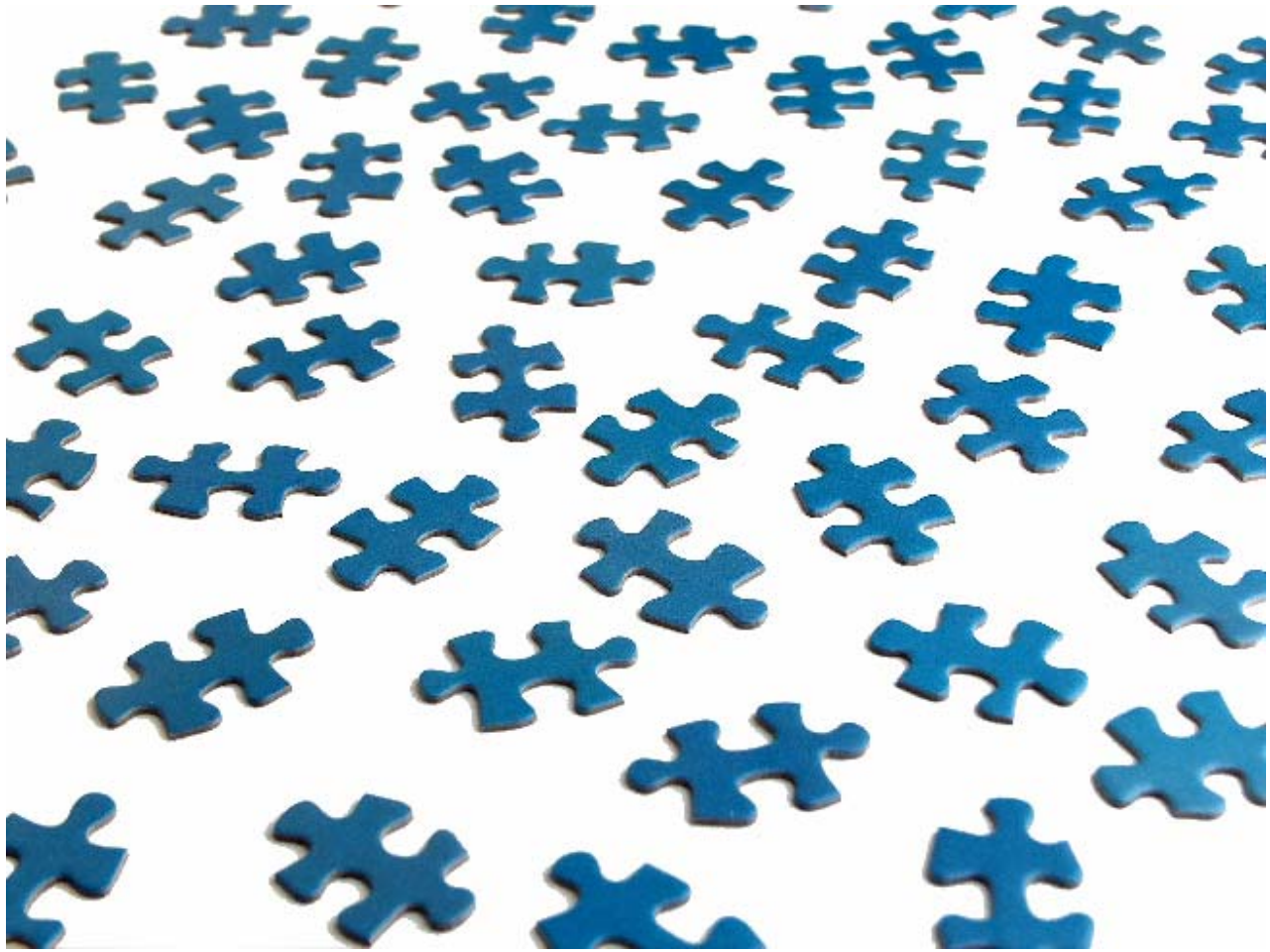
Integration



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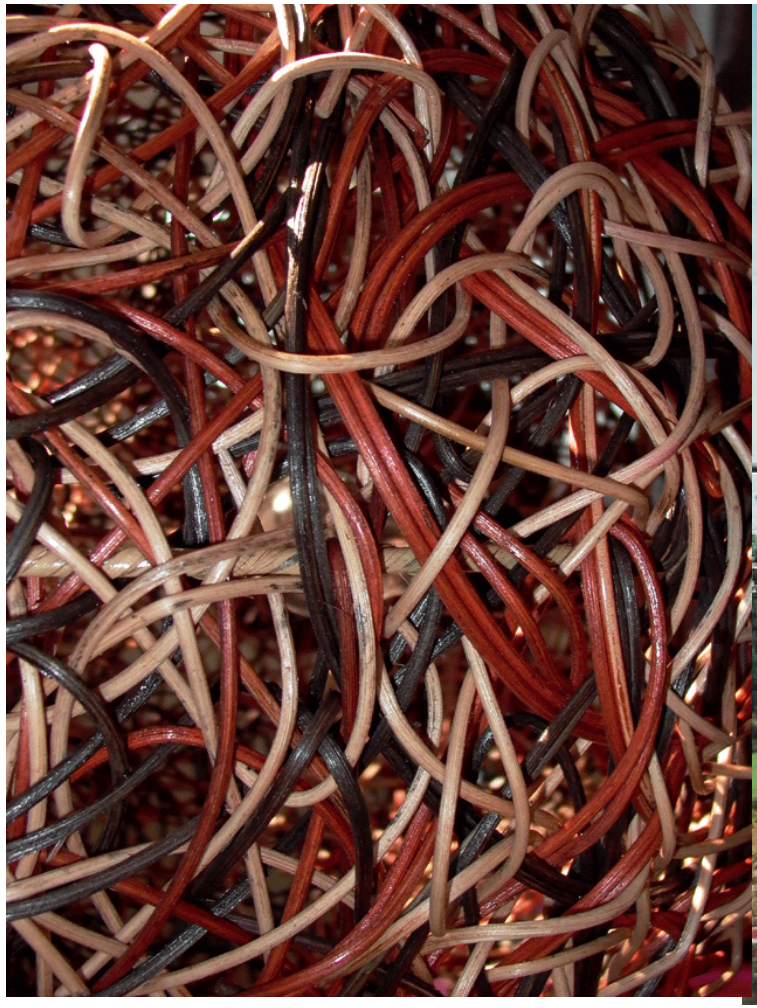
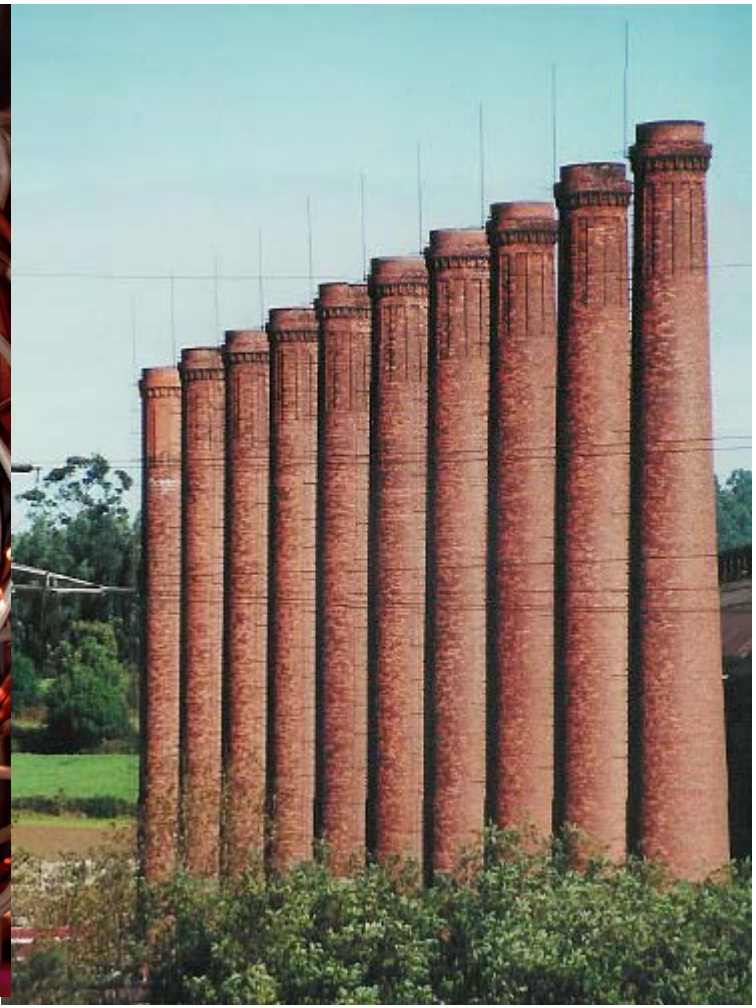
Take your pick!





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"Stovepipe" Model

- Each department / division managed its own systems
- Each system was 100% standalone
  - Robust
  - Easy to manage

  - Inflexible
  - Hard to integrate
  - Hard add new compliance

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Integration tangle

- Ad-hoc integration between systems
- Multiple technologies, protocols, systems
- Got the job done at the time
- Impossible to manage
- Dependencies have spread and no-one can change anything

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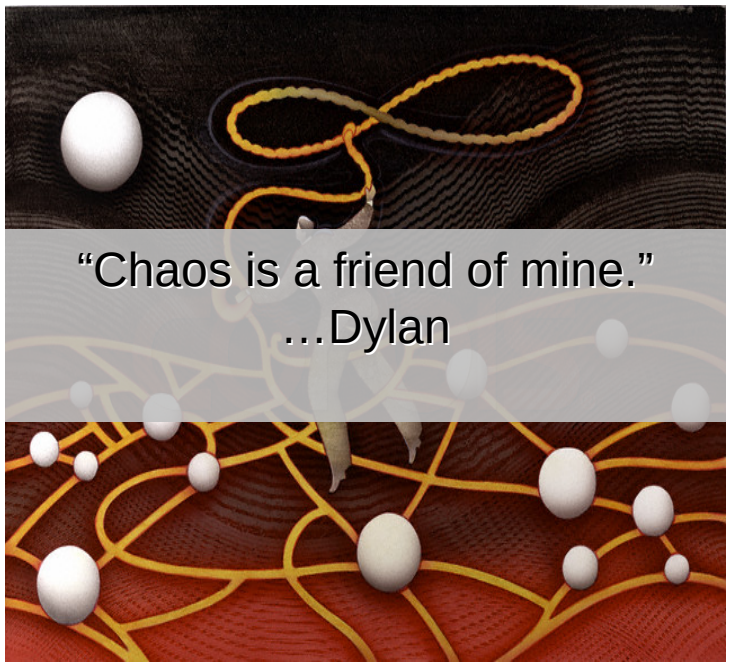
The ROI Paradigm....



- Creating the Ball
  - ROI = focus on the short-term (this month, quarter, maybe a year)
  - Least Expensive, Most Expedient Choice
  - Yarn Ball of connections, process and dependencies
    - Geometric ($n^{2)}$ compounding with each decision
    - More Expensive & Hopeless
- Must Untangle The Mess...Not Start Over

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Impact of the Web

- Anyone can use our applications
- And if they can't – they want to know why not!
- Virtualized distributed applications
- Accessible from anywhere
- Multi-tier architecture becomes common
- Urgent need to link applications:
  - Stock, Ordering, Shipping, Invoicing

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Further Motivation

- Mergers
  - Linking multiple systems from each organisation
- Demergers
  - Allowing simple separation of systems
    - With security, across the internet
- Outsourcing
  - Using services via the Internet

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Changed landscape

- Development cycles:
  - From 18 to 6 months to 3 months
- Real standards
  - HTTP, HTML, XML, Java
- Supply chain management and integration are key

Integrate or bust

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Exercise

Discussion

What kinds of integration channels do you have in your organization?

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Integration

- Model has been either:
  - Getting *Data* from one system to another
  - Using *Function* in one system from another
- Typically done using a network
  - Common data store, files, in-memory, cut and paste
  - Not forgetting the most common models:
    - Fax, typist, phone call, printout

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Integration points

- Data
  - Integration in the database layer
- Application
  - Inter-application integration
- Web tier
  - Portal based integration
- On-the-glass
  - Cut and paste

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What has fuelled the Internet?

- Open Standards
  - Different systems in different countries work in the same way
- Consistency
  - The same interface worked lots of places
  - Now people prefer web interfaces because they are familiar
- Ubiquity
  - Telcos made it available everywhere
- The network effect...
- Free-ish
  - But also ways to make money

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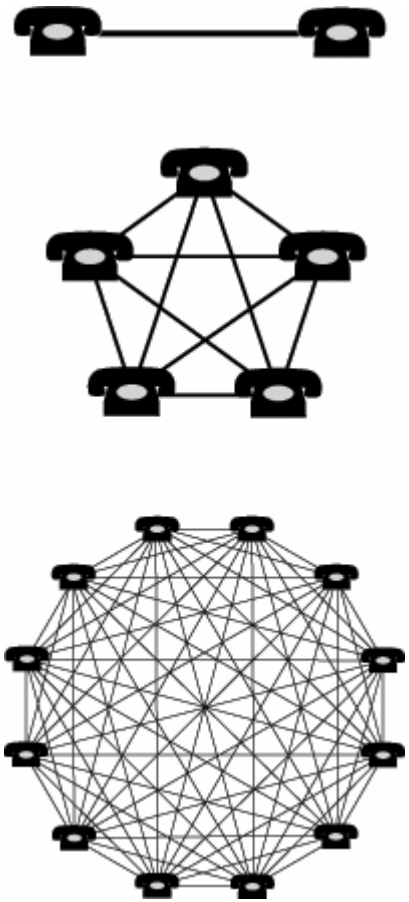
The Network Effect



Whoever bought that first fax machine got a really bad deal!!

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Before SOA

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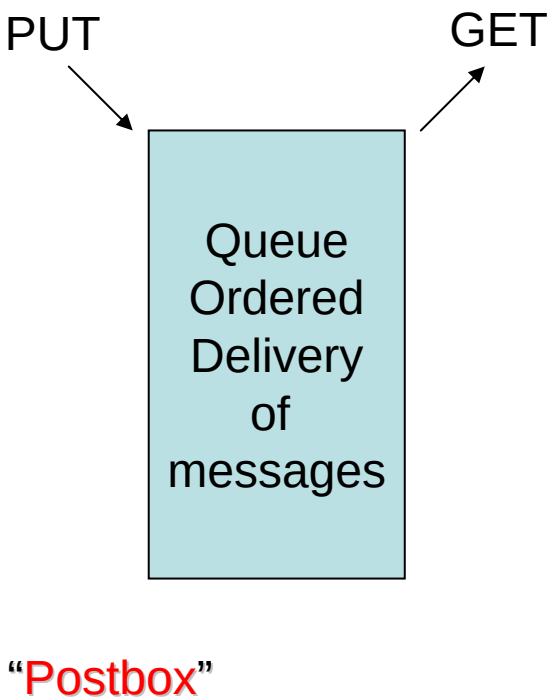
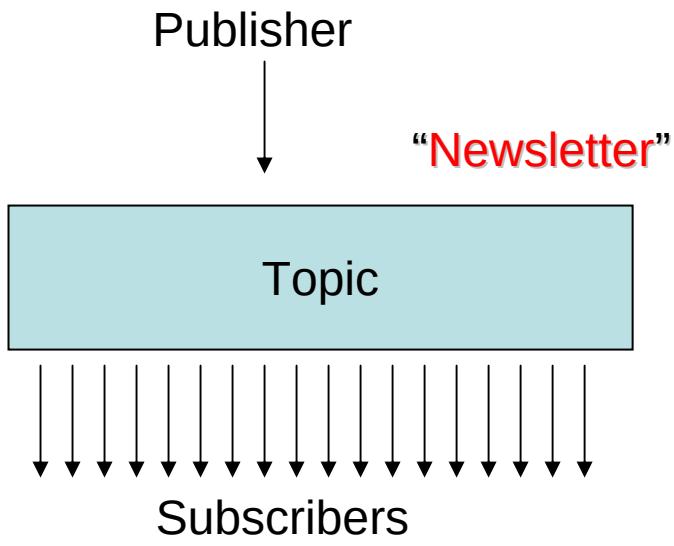
Message Oriented Middleware (MOM) "Loose Coupling 0.5"

- Kickstarted by IBM's MQSeries (queue based model) and Tibco (pub/sub model)





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MOM

- Key aspects
  - Separates each "side"
    - Common system independent API
    - Logical construct (Queue or Topic)
    - Systems are built independently of other applications
  - Systems exchange messages
    - Can be XML, Binary, textual
  - JMS provides a common API for MOM in Java but not a common wire protocol
  - Asynchronous – the two applications do not wait for each other

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CORBA / RPC

- RPC - "procedural" calls across a network
- RMI and CORBA – Object calls across a network

- Based on calling into another program
- The programs can be located across a network
  - But are tightly coupled by stubs and skeletons
  - Synchronous

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Object serialization

- Java RMI and other distributed object systems rely on serializing objects
  - Using inbuilt capabilities in the platform to encode a set of bytes that represents the object
- Has significant issues
  - Default serialization is not efficient
  - Usually need the same version of the code at each end – leading to migration issues

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Synchronous vs Asynchronous

- Synchronous communication is most familiar to application developers
- Synchronous applications
  - Can run out of threads (block)
  - Require the other side to be available
    - No batch, downtime, etc
    - Replicate a failure across the whole integration
  - Scale poorly
    - Bottlenecking
  - But still, synchronous integration links are wide-spread and can be effective

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Hub vs point-to-point

- A hub model can reduce the number of connections
- A point-to-point model doesn't suffer from a single point of failure
- A combination of the two emerging as a bus model
  - No dependency on a single point of integration

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Interfaces and message formats

- RPC, RMI and CORBA are very concerned with interfaces
  - Typically tightly coupled interfaces
  - Based on specific stubs and skeletons
- MoM is the opposite:
  - Delivers the message
  - No concern with the payload
  - However, many people use XML with MoM

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Brokering

- Some MoM systems have been expanded to include message transformation and formats
  - Requires a registry or repository of message formats and structures
  - Can usually transform from one format to another

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Loose Coupling

- Types of Standards
  - De Jure Standard:
    - Created by organizations
  - De Facto Standard:
    - Created by a small group
    - Taken up widely because they are useful
- Often life is a combination of both:
  - TCP/IP and the Internet didn't **start** as Standards

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De Facto
An example (maybe)

- Rail Road Example (De Facto):
  - Rail Width = 4' 8.5"
  - First English railways based on carts
  - Carts were based on ruts in old Roman roads
  - Ruts were based on Roman Chariots
  - Roman Chariots based on the width of two horses
  - So:
    - Now you know which horse's rear invented standards

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The Role of Open Standards

- Not proprietary to any one company
- Available for anyone to develop or use
- Supports Interoperability
- Prevents "Lock-In"

- Some Issues:
  - Standards Are Agreements = Compromise.
  - Too Many of Them, Tremendous Confusion and Overlap Until The Dust Settles

- The "right" Standards improve reuse, agility, and adoption

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Tightly coupled

- Tightly coupled systems have significant problems:
  - Errors, delays and downtime spread through the system
  - The resilience of the whole system is based on the weakest part
  - Cost of upgrading or migrating spreads
  - Hard to evaluate the useful parts from the dead weight

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Loose coupling

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Loose Coupling

- Is about allowing enough flexibility in the system to let it work
- In fact its not a new idea:
  - Most every early integration system had loose-coupling
  - They were known as employees

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"6 Degrees of Separation"

- Location
- Access
- Programming Language
- Stack/Vendor
- Time
- Scalability

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What is a Service?

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Service?

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Service?

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Service

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Service

- Services are **application assets** that provide useful function
- The service is not just the software... it is the **running** system
- Services are **accessible** in a common way across the network and organisation
- Services are **re-usable building blocks** that can be re-used to build other applications

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Loosely Coupled

- Services are fundamentally
  - ***Message based***
- Can be *Asynchronous*
- No dependency on a given technology or language
  - Based on XML, or some other neutral message structure
- No dependency on a given system – can be migrated, relocated or replaced

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What does a service look like?

- It has to be running somewhere!
- We all know what services are because we use them every day:
  - Yahoo Finance to check on share prices
  - Google Maps to find things
  - Weather pages to get a forecast

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A service is not:

```
public class Spy implements Service {
    public Information
        checkEmployee(Employee e) {
            return this.whatAreTheyUpTo(e);
    }
}
```

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The external view of a Service

- What does it do? The function
  - Typically human-readable documentation
- How can I use it?
  - The Interface – messages in and out, their format
  - Requirements – what security model? Relaibility?
  - Capabilities – does it support digital signatures?
- The Service Level Agreement (SLA)
  - What response time guarantees are there?
  - When is it up?
- How much does it cost?

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The internal view of a Service

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Contracts

- Contract based development
- Start with the business need not the code
- Build high-level process definitions and data models
- Agree SLAs, Reliability and Security Requirements

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Contracts are Standards

- Maybe not industry wide – but enough to get some "network effect"

Remember this:

- Not proprietary to any one ~~company~~ department
- Available for anyone to develop or use
- Supports Interoperability
- Prevents "Lock-In"

- Some Issues:
  - Standards Are Agreements = Compromise.
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Object oriented vs Service Oriented

- Object-Oriented design allows complexity to be modeled and managed effectively
  - But that complexity should not spread
- Cross-applications require a different approach
  - Limit the complexity to services
  - Keep the gaps between the services as simple as possible

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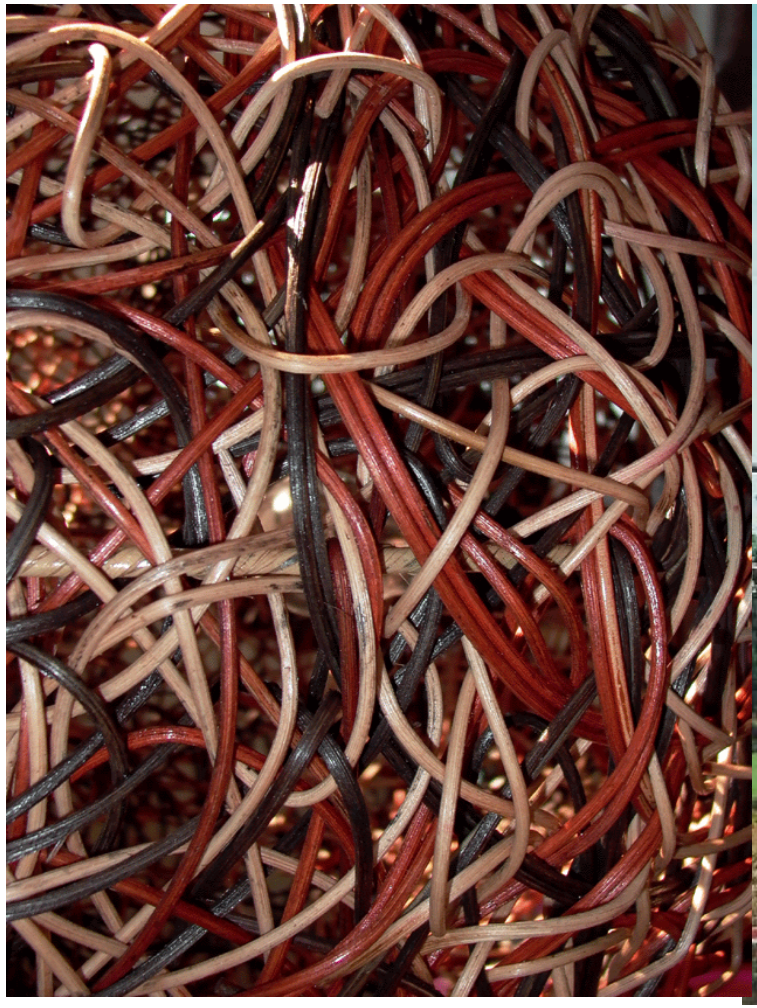
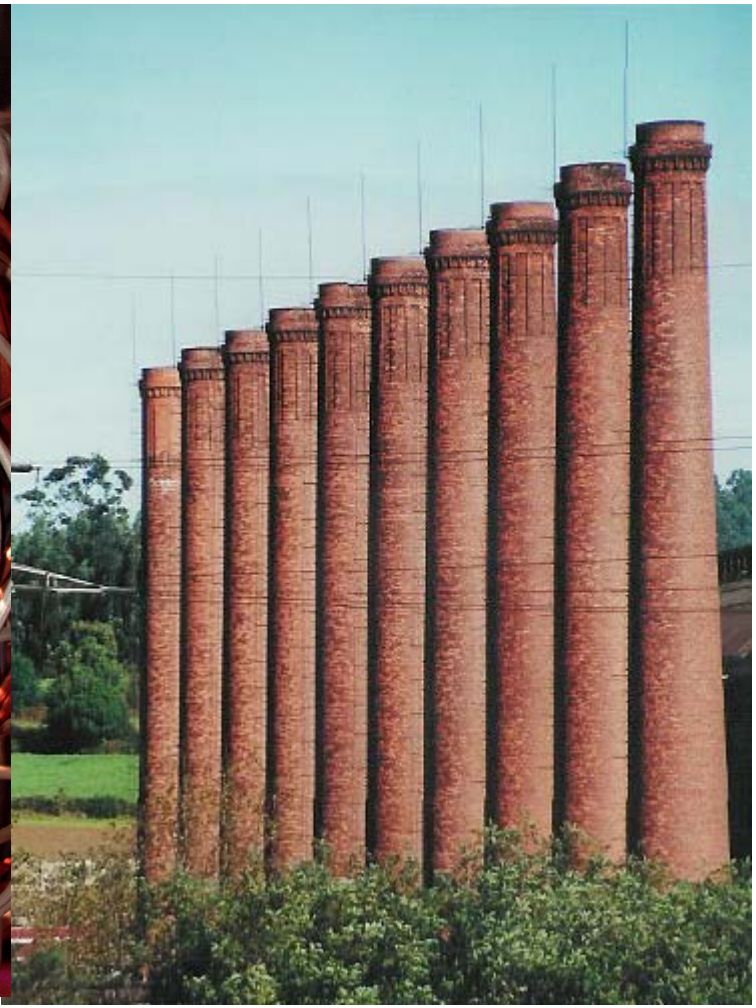
SOA moves from:...





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...to:

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The best of both worlds

- The asynchronous *message* based model of MoM
- The well-defined interfaces of RMI, Corba, RPC

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Service Oriented Architecture

- Emerged from:
  - Web based systems
  - Multi-tier architecture
  - Pressure to integrate
- Applications are exposed to the rest of the business as services
- SOA requires that services:
  - Published, available and **documented**
  - Have **contracts**
  - Are **re-usable**

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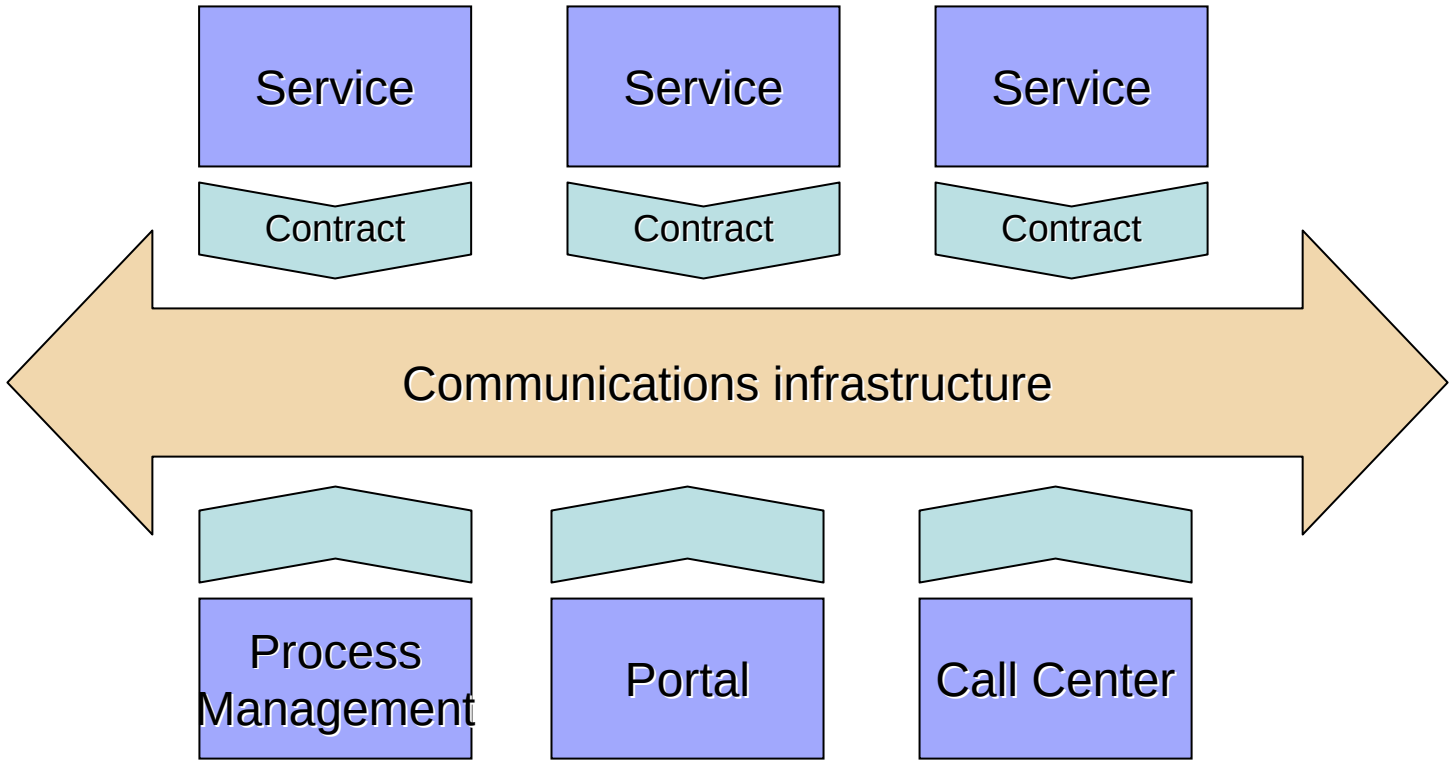
Service Oriented Architecture



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Service Oriented Architecture

- SOA is gaining in popularity because it simplifies connecting systems.
- Integration is being driven by a number of factors:
  - **Straight-through-processing**
    - Handling web transactions without manual intervention, leading to greater scalability
  - **Mergers and demergers**
    - The increasing change in organisational structure is making loosely-coupled connections more important
  - **Partnerships, value-chains, outsourcing**
    - The ability to efficiently do business with third-parties is driving web-based integration technologies
  - **Time-to-Value**
    - Companies are demanding faster results from IT
    - SOA enables faster development of business processes using BPM tools and re-using existing services

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Service Oriented Architecture

- SOA is an Enterprise Architecture not an application architecture
  - At a level higher than Object-Orientation
- The primary concept is loose-coupling
- Individual applications utilize *services* from across the network to provide common function
- The user of a service is independent of the implementation of any services it uses.

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SOA and Business

- SOA is about aligning IT to the business
- Services should be owned, managed and organised by business domain
  - Not by business unit

- A domain is a related set of business function
  - With a common purpose and model

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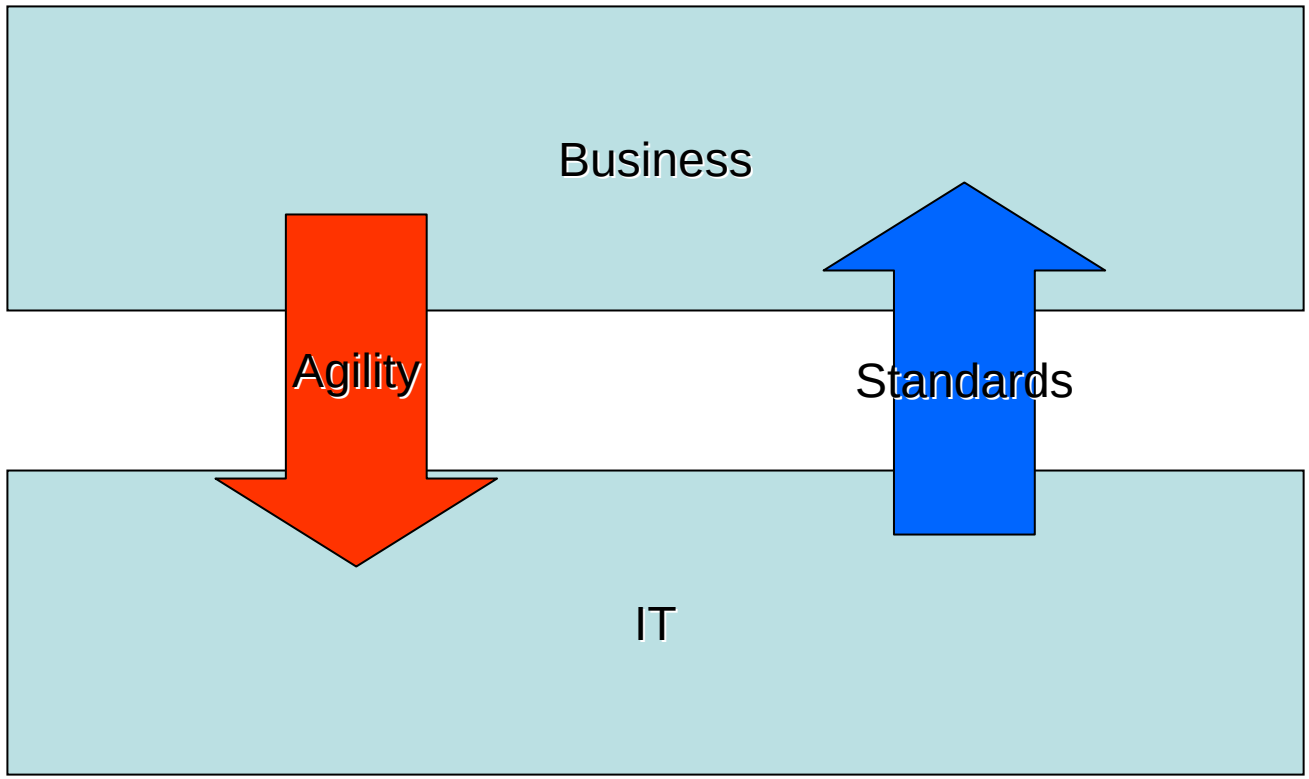
One way of looking at SOA



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Summary

- SOA:
  - Aligns IT to **business**
  - Delivers on **Loose-coupling**
  - Makes **re-use** possible shortening development cycles
  - Enables better **integration**

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Resources

- http://www.enterpriseintegrationpatterns.com/
- http://www.looselycoupled.com

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Questions?